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by Lauren Pinault and Vitali Fioletov

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Sun exposure, sun protection and sunburn among Canadian adults

by Lauren Pinault and Vitali Fioletov

Abstract

Background: Ultraviolet radiation (UVR) exposure and a history of sunburn are important risk factors for skin cancer. Sunburn is more common among men, younger age groups, and people in higher income households. Sun protection measures also vary by sex, age, and socioeconomic characteristics. Associations between ambient UVR and sunburn and sun safety measures have not been quantified.

Data and methods: A total of 53,130 respondents aged 18 or older answered a Canadian Community Health Survey (CCHS) module on sun safety, which was administered in six provinces from 2005 to 2014. The module contained questions about sunburn, time in the sun, and sun protection. These respondents were linked to an ambient erythemal UVR dataset representing the June-to-August mean. Descriptive statistics and logistic regression were used to examine associations between population characteristics, sunburn, sun safety, time in the sun, and ambient UVR.

Results: Sunburn was reported by 33% of respondents and was more common among men, younger age groups, people who were not members of visible minorities, residents of higher income households, and individuals who were employed. On a typical summer day, a larger percentage of women than men sought shade and wore sunscreen, whereas a larger percentage of men wore a hat or long pants. As ambient summer UVR increased, women were more likely to apply sunscreen to their face, seek shade, or wear a hat (OR~1.02 to 1.09 per increase of 187 J/m^2 of erythemally-weighted UVR, or 5.4% of the mean); these associations were not observed among men.

Interpretation: Findings related to sunburn and sun protection were similar to those of previous studies. The association between ambient UVR and women's precautionary measures suggests that information about UVR may influence their decision to protect their skin.

Keywords: Canadian Community Health Survey, melanoma, skin cancer, sun safety, sunlight

Skin cancers have the highest incidence of all cancers in Canada.[1,2] The Canadian Cancer Society estimated 6,800 new cases of cutaneous melanoma and 78,300 new cases of non-melanoma skin cancer in 2015.[2] From 1986 to 2010, the incidence of melanoma increased by 2% per year among men and 1.5% per year among women.[1]

The primary risk factor for all skin cancers is exposure to ultraviolet radiation (UVR), mainly from the sun, but also from indoor tanning.[1,3] UVR exposure is modified by time spent in the sun and personal protective behaviour. Based on Canadian and American surveys, 30% to 40% of adults use sunscreen or seek shade, and 30% to 45% of men wear protective clothing.[4-6] Differences in sun protection practices have been observed between the sexes and age groups; for example, sunscreen is more commonly used by younger adults.[4-6]

A history of severe sunburn is also an important risk factor for melanoma and non-melanoma skin cancers.[7,8] Sunburn is usually the result of intermittent exposure to strong doses of UVR.[8] According to results of both the 2010 U.S. National Health Interview Survey and the 2006 National Sun Survey (Canada), 37% of adults reported at least one sunburn a year during summer months.[6,9] Sunburn is more common among men, younger age groups, outdoor workers, and persons of light skin colour and higher income.[6,9,10]

In addition to the comprehensive national portrait of sun protection behaviours in Canada offered by the 2006 National Sun Survey (n = 7,121),[6] an optional Sun Safety Module (SSM) of the Canadian Community Health Survey (CCHS) interviewed 58,120 respondents between 2005 and 2014 in six provinces about many of the same behaviours. Based on SSM data, this study quantifies sunburns and sun protection practices during leisure time, by socioeconomic and demographic characteristics in this larger, though not nationally representative, sample. As a novel contribution, the study also evaluates associations between ambient erythemal UVR (estimated at a respondent's place of residence) and sunburn and sun protection behaviours.

Methods

Data sources

The Canadian Community Health Survey (CCHS) is a cross-sectional survey of Canadians aged 12 or older that compiles health data using a sampling frame based on health regions. The CCHS was conducted biennially from 2000 through 2007, and annually thereafter. It excludes residents of Indian reserves and Aboriginal settlements, institutions, and some remote northern communities, and full-time members of the Canadian Forces.[11] An optional Sun Safety Module (SSM) was selected by six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan, and Alberta) in different years during the 2005-to-2014 period. The module contained questions about sunburn in the past 12 months, time in the sun, and sun protection[12-16]; occupational sun exposure was not assessed. Of the 58,120 SSM respondents (combined cycles), 4,990 were children aged 12 to 17, who were excluded from the present study because of the confounding role of adult involvement in their sun safety behaviour (which was not evalu-

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ated by the SSM). The analysis pertains to 53,130 respondents aged 18 or older. Because the SSM was administered in different provinces and years (Table 1), it was not possible to examine changes over time.

Ambient UVR data represent estimates of daily UVR doses for erythemal (sunburn) spectrum (in Joules per m^2) for each month of the year on a 1° by 1° grid developed at Environment and Climate Change Canada.[17] These estimates have been validated with ground estimates from Brewer spectrophotometers in Canada and the United States.[17] A link between UVR climatological values and risk of melanoma has been established for Canada.[18] Because exposure to ambient UVR in Canada occurs primarily during the summer, and sun safety questions were asked for a typical summer day, mean daily erythemal UVR doses for June, July and August were used to estimate ambient summer UVR.

Using a Geographic Information System (GIS) (ArcGIS v.10, ESRI 2010), UVR estimates were created for SSM respondents at their place of residence, based on their postal code. Representative points for respondent postal codes were assigned with Statistics Canada's Postal Code Conversion Plus (PCCF+) version 6C, using a population-weighted random allocation algorithm.[19]

Statistical analysis

Respondents to the SSM were asked if they had had a sunburn on any part of their body in the past 12 months, and the amount of time between 11:00 a.m. and 4:00 p.m. that they spent in the sun on a typical weekend or day off in the summer.[20] Respondents who reported at least 30 minutes in the sun (in scope) were asked about protective measures: In the summer months, on a typical weekend or day off, when you are in the sun for 30 minutes or more, how often do you ... seek shade, wear a hat, wear long pants or a skirt, use sunscreen on your face or body.[12-16] A dichotomous variable for each question was created to identify

Table 1
Selected socioeconomic characteristics of study sample, by response status to sunburn and protective behaviour questions, household population aged 18 or older, six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta), 2005 to 2014

Socioeconomic characteristics	Number[1] of respondents	%	Sunburn question		Protective behaviour questions[2]		
			Response (%)	Non-response (%)	Response (%)	Out of scope (%)[3]	Non-response (%)
Total	53,130	100.0	98.0	2.0	68.5	27.7	3.8
Sex							
Men	23,810	44.8	97.1	2.9	75.9	19.0	5.1
Women	29,320	55.2	98.7	1.3	62.5	34.8	2.7
Age group (years)							
18 to 29	8,660	16.3	98.5	1.5	87.0	10.7	2.3
30 to 39	7,870	14.8	98.8	1.2	83.1	14.8	2.1
40 to 49	7,580	14.3	98.9	1.1	76.8	20.9	2.2
50 to 59	9,970	18.8	99.0	1.0	69.4	27.9	2.7
60 to 69	9,310	17.5	98.3	1.7	59.9	36.1	4.0
70 to 79	6,180	11.6	96.5	3.5	46.6	46.7	6.7
80 or older	3,560	6.7	91.9	8.1	31.8	56.6	11.6
Visible minority status							
Not visible minority	48,110	90.6	98.1	1.9	69.1	27.3	3.6
Visible minority	2,290	4.3	97.9	2.1	56.9	39.3	3.8
Not stated/Not applicable	2,730	5.1	96.9	3.1	67.0	25.3	7.6
Household income quintile							
1 (lowest)	11,130	20.9	97.7	2.3	53.0	42.8	4.2
2	11,510	21.7	96.9	3.1	62.3	32.4	5.3
3	10,420	19.6	98.2	1.8	70.8	25.6	3.6
4	9,910	18.7	98.4	1.6	77.0	19.8	3.2
5	10,170	19.1	99.0	1.0	81.8	15.9	2.3
Employment status							
Employed	29,610	55.7	99.3	0.7	79.3	18.6	2.0
Unemployed	15,410	29.0	98.2	1.8	62.9	33.4	3.7
Unable to work	1,570	3.0	91.0	9.0	44.0	45.9	10.1
Not stated/Not applicable	6,550	12.3	93.5	6.5	38.4	51.2	10.4
Province (survey years)							
Prince Edward Island (2005 to 2010)	5,700	10.7	97.8	2.2	69.1	28.0	3.0
Nova Scotia (2009 to 2010)	4,290	8.1	97.3	2.7	70.9	25.6	3.4
New Brunswick (2011 to 2012)	4,450	8.4	97.6	2.4	71.1	25.9	2.9
Quebec (2009 to 2010)	21,280	40.1	98.2	1.8	63.9	32.8	3.3
Saskatchewan (2013 to 2014)	6,810	12.8	97.8	2.2	73.0	19.9	7.1
Alberta (2005 to 2006)	10,600	20.0	98.2	1.8	72.4	24.0	3.6

[1] rounded to nearest 10; may not sum to totals because of rounding

[2] percentages calculated based on question for seeking shade, which had lowest response rate

[3] spent none or less than 30 minutes per day in sun between 11:00 a.m. and 4 p.m. on typical weekend or day off during summer months

Source: Canadian Community Health Survey optional content: Sun Safety Module, 2005 to 2014.

respondents who answered affirmatively ("always" or "sometimes").[8,10] Sex, age, visible minority status, household income quintile, and employment status were included in the analysis. Income quintiles were determined from the CCHS household income distribution variable, which is derived from self-reported total personal income, household size, and geography.[12-16] Skin type data were not available. Erythemal UVR data were transformed to a z-score, where 1 unit corresponded to 1 standard deviation (187 J/m^2, or 5.4% of average exposure among all respondents).

To describe time in the sun and protective behaviour, binomial proportions were calculated for the mean and 95% Wilson confidence limits. Logistic regression was used to investigate associations between the odds of sunburn and socioeconomic characteristics, time in the sun, and ambient UVR; the odds of sunburn related to various protective behaviours; and the odds of reporting a protective behaviour related to ambient UVR. CCHS survey weights were used to estimate representative population means in the provinces that were sampled. Before analysis, survey weights were divided by the number of study periods (five two-year periods). When appropriate, analyses were stratified by sex.

Results

Study population

Selected characteristics of the 53,130 adult respondents to the SSM are provided in Table 1. The study was not nationally representative—the majority of respondents lived in Quebec (40%) or Alberta (20%). Almost all (98%) respondents answered the sunburn question, regardless of their socioeconomic characteristics. For the sun protection question, 69% of respondents provided an answer; response rates were higher among people who were younger, in higher income quintiles, and employed. These differences in response were largely due to differences in the out-of-scope population rather than to non-response, although non-response rates were high among people aged 80 or older and people who were unable to work. Mean June-through-August erythemal ambient UVR was 3,479 J/m^2 (range 2,789 to 4,111 J/m^2), and did not vary by socioeconomic characteristics (data not shown). Skin type data were not available, but 91% of respondents identified as not being members of a visible minority.

Sun exposure

On a "typical" summer day (weekend or day off), 13% of respondents did not spend any time in the sun from 11:00 a.m. to 4:00 p.m. Another 41% reported less than 2 hours, and smaller percentages reported 2 to 4 (29%) or more than 4 hours (17%).

The people who spent no time in the sun were more likely to be women, older, of lower household income, and unable to work (Table 2). Those who reported more than 4 hours in the sun were more often men, younger, not members of a visible minority, of higher income, and employed (Table 2).

Sun protection

Among people who spent at least half an hour in the sun on a "typical" summer day, the most common precaution was applying sunscreen to the face (45%) (Table 3). Somewhat smaller percentages sought shade (41%), wore a hat (39%), or used sunscreen on the body (38%). Just over a quarter (27%) wore long pants or a skirt.

Sun protection measures varied between the sexes: women were more likely than men to seek shade (46%) and use sunscreen on the face (63%) and body (51%); men were more likely than women to wear a hat (50%) or long pants (35%).

Table 2
Percentage spending no time or more than 4 hours in sun, by selected socioeconomic characteristics, household population aged 18 or older, six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta), 2005 to 2014

	Time in sun					
	None			More than 4 hours		
		95% confidence interval			95% confidence interval	
Socioeconomic characteristics	%	from	to	%	from	to
Total	13.4	13.4	13.5	17.1	17.0	17.1
Sex						
Men	9.2	9.2	9.3	22.1	22.0	22.2
Women	17.5	17.4	17.5	12.2	12.1	12.3
Age group (years)						
18 to 29	5.3	5.2	5.4	22.6	22.5	22.7
30 to 39	6.8	6.7	6.9	19.0	18.9	19.1
40 to 49	9.3	9.2	9.4	19.2	19.1	19.3
50 to 59	15.0	14.9	15.1	15.9	15.8	16.0
60 to 69	21.5	21.4	21.7	12.8	12.7	13.0
70 to 79	32.2	31.9	32.4	7.6	7.5	7.7
80 or older	40.6	40.2	40.9	3.9	3.8	4.1
Visible minority status						
Not visible minority	12.9	12.9	13.0	17.9	17.8	18.0
Visible minority	17.5	17.3	17.6	7.3	7.2	7.4
Household income quintile						
1 (lowest)	23.0	22.9	23.1	12.2	12.1	12.3
2	16.5	16.4	16.6	15.1	15.0	15.2
3	12.5	12.4	12.6	17.7	17.6	17.8
4	8.6	8.5	8.6	18.8	18.7	19.0
5	6.9	6.8	7.0	21.4	21.3	21.5
Employment status						
Employed	8.8	8.7	8.8	19.5	19.5	19.6
Unemployed	18.2	18.1	18.3	13.7	13.6	13.8
Unable to work	30.2	29.8	30.7	8.5	8.3	8.8

Source: Canadian Community Health Survey optional content: Sun Safety Module, 2005 to 2014.

Table 3
Percentage reporting protective behaviour,† by selected socioeconomic characteristics and time in sun, household population aged 18 or older, six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta), 2005 to 2014

	Seek shade			Wear hat			Wear pants/ long skirt			Sunscreen on face			Sunscreen on body		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
Socioeconomic characteristics and time in sun	%	from	to	%	from	to	%	from	to	%	from	to	%	from	to
Total	40.5	40.4	40.5	39.3	39.2	39.3	27.1	27.0	27.2	44.8	44.8	44.9	37.6	37.5	37.6
Sex															
Men	35.6	35.5	35.7	49.6	49.5	49.7	34.6	34.5	34.7	28.8	28.7	28.9	25.9	25.8	26.0
Women	46.0	45.9	46.1	27.4	27.3	27.5	18.5	18.4	18.6	63.1	63.0	63.3	50.9	50.8	51.0
Age group (years)															
18 to 29	30.0	29.8	30.1	28.4	28.2	28.5	19.2	19.1	19.3	44.0	43.9	44.2	38.3	38.2	38.5
30 to 39	37.9	37.7	38.1	37.3	37.1	37.5	19.0	18.8	19.1	49.7	49.5	49.9	43.3	43.1	43.5
40 to 49	42.3	42.1	42.4	37.3	37.1	37.5	22.0	21.9	22.2	47.5	47.4	47.7	40.9	40.7	41.0
50 to 59	46.7	46.5	46.9	43.0	42.8	43.2	32.4	32.3	32.6	45.8	45.7	46.0	37.3	37.2	37.5
60 to 69	49.2	49.0	49.5	53.7	53.4	53.9	43.6	43.4	43.8	38.2	38.0	38.4	29.0	28.8	29.3
70 to 79	51.3	51.0	51.7	59.3	59.0	59.7	54.4	54.1	54.8	34.4	34.1	34.8	23.7	23.4	24.0
80 or older	48.6	48.0	49.2	58.1	57.5	58.7	61.5	60.9	62.1	26.8	26.2	27.3	14.1	13.6	14.5
Visible minority status															
Not visible minority	40.7	40.6	40.8	39.6	39.6	39.7	26.3	26.2	26.4	46.5	46.4	46.5	38.9	38.8	39.0
Visible minority	39.2	38.9	39.4	34.7	34.4	35.0	32.9	32.6	33.2	31.0	30.7	31.3	25.5	25.2	25.7
Household income quintile															
1 (lowest)	40.9	40.7	41.1	36.0	35.9	36.2	32.9	32.7	33.0	35.5	35.4	35.7	29.8	29.6	30.0
2	43.1	43.0	43.3	38.9	38.7	39.1	30.6	30.5	30.8	40.2	40.0	40.4	33.1	32.9	33.2
3	39.3	39.1	39.4	38.5	38.4	38.7	27.2	27.0	27.3	45.5	45.3	45.6	38.7	38.5	38.9
4	41.4	41.3	41.6	39.2	39.1	39.4	23.2	23.1	23.4	49.1	48.9	49.2	41.0	40.8	41.1
5	38.0	37.8	38.1	42.6	42.4	42.7	23.8	23.7	23.9	50.5	50.4	50.7	42.5	42.4	42.7
Employment status															
Employed	38.2	38.1	38.3	37.5	37.4	37.6	23.8	23.7	23.9	46.2	46.1	46.3	39.7	39.6	39.7
Unemployed	46.2	46.0	46.4	41.9	41.8	42.1	32.7	32.6	32.9	43.6	43.5	43.8	34.5	34.3	34.6
Unable to work	50.4	49.7	51.1	44.4	43.7	45.1	39.2	38.5	39.9	36.6	35.9	37.3	28.8	28.2	29.5
Time in sun (hours)															
Less than 2	52.6	52.4	52.7	37.4	37.3	37.5	29.0	28.9	29.1	46.6	46.5	46.7	38.0	37.9	38.2
2 to 4	36.7	36.6	36.8	38.0	37.9	38.1	24.1	24.0	24.2	46.4	46.2	46.5	39.2	39.1	39.4
More than 4	27.1	27.0	27.3	44.4	44.2	44.5	29.1	28.9	29.2	39.3	39.2	39.5	33.9	33.8	34.1

† answered "always" or "sometimes" versus neutral or negative answers

Note: Respondents were out of scope for the protective behaviour questions if they spent no time or less than 30 minutes per day in the sun between 11 a.m. and 4 p.m. on a typical weekend or day off during the summer.

Source: Canadian Community Health Survey optional content: Sun Safety Module, 2005 to 2014.

Seeking shade and wearing protective clothing were more common at older ages. Sunscreen use was more frequently reported by younger individuals. People who lived in higher-income households or who were employed were more likely to use sunscreen and less likely to wear pants/long skirt than were residents of lower-income households and those who were not employed.

Multiple logistic regression models were used to determine if ambient UVR and precautionary measures were associated. Among men, a small, negative association emerged between ambient UVR and the use of the sun protection, except for sunscreen on the body (Table 4). By contrast, with increasing ambient UVR, women were more likely to report most protective measures, particularly seeking shade (OR = 1.07; 95% CI: 1.06 to 1.08), wearing a hat (OR = 1.09; 95% CI: 1.09 to 1.10), and applying sunscreen to the face (OR = 1.07; 95% CI: 1.06 to 1.07).

Sunburn

A third (33%) of SSM respondents had had a sunburn in the past 12 months—30% of women and 37% of men. Sunburns with a blister were reported by 3% of respondents, and 10% reported a sunburn that had been painful for more than one day (data not shown in tables). Logistic regression results indicate that men were more likely than women to have had a sunburn (OR = 1.21; 95% CI: 1.20 to 1.22) (Table 5). However, for both sexes, the patterns of odds ratios for sunburn by socioeconomic characteristics and time in the sun were similar. In general, sunburn was observed less frequently with advancing age, and among members of visible minorities (OR = 0.20; 95% CI: 0.20 to 0.20). The odds of sunburn rose with household income quintile and were higher among people who were employed and those who spent more leisure time in the sun. The negative association between ambient UVR and sunburn was weak, but statistically significant, among women.

According to results of a second logistic regression model that was used to determine the association between sunburn and protective behaviours, sunburn was reported less frequently by

Table 4
Adjusted odds ratios relating increase in ambient summer ultraviolet radiation (UVR) Z-score to protective behaviour, by sex, household population aged 18 or older, six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta), 2005 to 2014

	Total			Men			Women		
	Adjusted[3] odds ratio[5]	95% confidence interval		Adjusted[3] odds ratio[5]	95% confidence interval		Adjusted[3] odds ratio[5]	95% confidence interval	
Protective[1] behaviour		from	to		from	to		from	to
Seek shade	1.00*	1.00	1.01	0.95*	0.94	0.95	1.07*	1.06	1.08
Wear hat	1.02*	1.01	1.02	0.97*	0.96	0.97	1.09*	1.09	1.10
Wear pants/long skirt	0.91*	0.90	0.91	0.83*	0.83	0.84	1.05*	1.04	1.05
Sunscreen on face	1.02*	1.02	1.03	0.98*	0.97	0.98	1.07*	1.06	1.07
Sunscreen on body	1.02*	1.01	1.02	1.00	1.00	1.01	1.02*	1.02	1.03

* significant odds ratio ($p < 0.05$)
[1] answered "always" or "sometimes" versus neutral or negative answers
[3] adjusted for sex (in total model), age, and time in sun
[5] odds ratios reported per 1 standard deviation increase (1 unit Z-score) in ambient UVR in summer months (June, July, August)
Note: Respondents were out of scope for the protective behaviour questions if they spent no time or less than 30 minutes per day in the sun between 11:00 a.m. and 4 p.m. on a typical weekend or day off during the summer.
Source: Canadian Community Health Survey optional content: Sun Safety Module, 2005 to 2014 linked to UVR dataset (Environment Canada).

Table 5
Adjusted odds ratios relating sunburn in past 12 months to selected socioeconomic characteristics, time in sun and ambient summer ultraviolet radiation (UVR), by sex, household population aged 18 or older, six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta), 2005 to 2014

	Total			Men			Women		
	Adjusted[1] odds ratio	95% confidence interval		Adjusted[1] odds ratio	95% confidence interval		Adjusted[1] odds ratio	95% confidence interval	
Socioeconomic characteristics, time in sun and ambient summer UVR		from	to		from	to		from	to
Sex									
Men	1.21*	1.20	1.22	...	...	...	...	...	...
Women[‡]	1.00	...	...	...	...	...	...	...	...
Age group (years)									
18 to 29[‡]	1.00	...	...	1.00	...	...	1.00	...	...
30 to 39	0.65*	0.64	0.65	0.80*	0.79	0.81	0.53*	0.52	0.53
40 to 49	0.47*	0.47	0.48	0.58*	0.57	0.58	0.39*	0.38	0.39
50 to 59	0.26*	0.26	0.27	0.33*	0.33	0.34	0.21*	0.21	0.21
60 to 69	0.15*	0.14	0.15	0.17*	0.16	0.17	0.13*	0.12	0.13
70 to 79	0.07*	0.07	0.07	0.09*	0.09	0.09	0.06*	0.06	0.06
80 or older	0.05*	0.05	0.05	0.09*	0.08	0.10	0.03*	0.02	0.03
Visible minority status									
Not visible minority[‡]	1.00	...	...	1.00	...	...	1.00	...	...
Visible minority	0.20*	0.20	0.20	0.16*	0.15	0.16	0.25*	0.24	0.25
Household income quintile									
1 (lowest)[‡]	1.00	...	...	1.00	...	...	1.00	...	...
2	1.24*	1.23	1.26	1.21*	1.19	1.23	1.30*	1.28	1.32
3	1.22*	1.21	1.24	1.19*	1.18	1.21	1.28*	1.26	1.30
4	1.47*	1.45	1.48	1.53*	1.51	1.55	1.43*	1.41	1.46
5	1.53*	1.51	1.54	1.50*	1.48	1.52	1.59*	1.57	1.62
Employment status									
Employed[‡]	1.00	...	...	1.00	...	...	1.00	...	...
Unemployed	0.89*	0.88	0.90	0.96*	0.95	0.97	0.85*	0.85	0.86
Unable to work	0.60*	0.58	0.62	0.52*	0.50	0.54	0.70*	0.67	0.73
Time in sun (hours)									
None[‡]	1.00	...	...	1.00	...	...	1.00	...	...
Less than 2	2.02*	2.00	2.05	1.91*	1.88	1.95	2.06*	2.02	2.10
2 to 4	2.89*	2.85	2.93	2.49*	2.44	2.54	3.19*	3.13	3.25
More than 4	2.88*	2.84	2.92	2.64*	2.59	2.69	2.97*	2.91	3.03
UVR Z-score	0.97*	0.97	0.98	1.00	1.00	1.01	0.94*	0.94	0.95

... not applicable
* significantly different from reference category ($p < 0.05$)
[1] adjusted for sex, age, visible minority status, household income quintile, employment status, time in sun, UVR Z-score
[‡] reference category
Source: Canadian Community Health Survey optional content: Sun Safety Module, 2005 to 2014 linked to UVR dataset (Environment Canada).

Table 6
Adjusted odds ratios relating sunburn in past 12 months to protective behaviour, by sex, household population aged 18 or older, six provinces (Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta), 2005 to 2014

	Total			Men			Women		
	Adjusted[†] odds ratio	95% confidence interval		Adjusted[†] odds ratio	95% confidence interval		Adjusted[†] odds ratio	95% confidence interval	
Protective behaviour		from	to		from	to		from	to
Seek shade	0.90*	0.89	0.91	0.93*	0.92	0.94	0.92*	0.92	0.93
Wear hat	0.92*	0.91	0.92	1.01*	1.00	1.02	0.79*	0.78	0.80
Wear pants/long skirt	0.66*	0.65	0.67	0.71*	0.70	0.72	0.55*	0.55	0.56
Sunscreen on face	1.20*	1.19	1.20	1.34*	1.33	1.35	1.07*	1.05	1.08
Sunscreen on body	1.14*	1.13	1.15	1.23*	1.22	1.25	1.07*	1.05	1.08

* significant odds ratio ($p < 0.05$)
[†] combined models include all protective behaviours and are adjusted for age, sex (in total model), and time in sun
Source: Canadian Community Health Survey optional content: Sun Safety Module, 2005 to 2014.

people who wore pants or a long skirt (OR = 0.66; 95% CI: 0.65 to 0.67), and among those who sought shade (OR = 0.90; 95% CI: 0.89 to 0.91) (Table 6). However, sunburn was more commonly reported by men who wore a hat (OR = 1.01; 95% CI: 1.00 to 1.02) and by people who used sunscreen on the face (OR = 1.20; 95% CI: 1.19 to 1.20) or body (OR = 1.14; 95% CI: 1.13 to 1.15).

Discussion

This study examined associations between demographic and socioeconomic characteristics, sun protection behaviour, and sunburn, and the influence of ambient summer erythemal UVR on these outcomes. For women, but not men, a positive association was observed between living in a region with higher ambient UVR and sun safety behaviour. This suggests that women may be more influenced by information about ambient UVR from UV index/public health messaging. A weak negative association was observed between UVR and the incidence of sunburn, indicating that other mediators of exposure (for instance, behaviour) may play a more important role.

Although they pertain to only six provinces, the findings of this study were similar to those of national studies in Canada and the United States. The incidence of sunburn was 33%, which was slightly below estimates from the National Sun Survey (Canada) and the National Health Interview Study (U.S.)—37%.[6,9] Sunburn was more common among men, younger age groups, and residents of higher income households.[5,9,10] Because sunburn is a major risk factor for melanoma, these results are consistent with the higher risk of melanoma among men and people with higher income.[18] In line with previous studies, women were more likely than men to stay in the shade and to apply sunscreen, while men were more likely to wear protective clothing, including hats.[4-6] Also consistent with earlier research, sunscreen use was most common among younger adults (ages 30 to 39).[4,6]

As in a 2001 Canadian study, sun avoidance and protective clothing were associated with a lower risk of sunburn, while sunscreen users had a higher risk of sunburn.[10] Similar associations have been observed among American youth who reported sunscreen use, but often did not use it routinely or reapply it correctly.[21] Other reasons for the association between sunscreen use and sunburn may be that sunscreen is frequently applied in inadequate amounts or too late (after initial sun exposure).[10]

Limitations

The most important limitation of this study is that it is not national. Notably, Ontario, the province with the largest population and the highest ambient UVR, was excluded. However, the sample was large, and respondents were selected using a complex stratified sampling method within provinces that included sampling weights. Moreover, the results were similar to findings from the 2006 national survey.[6]

Ideally, sun safety questions would be asked at the end of summer or in the fall, but the SSM respondents were interviewed throughout the year, which may contribute to recall bias. Nonetheless, a meta-analysis concluded that recall bias is relatively low for questions asked about the previous 12 months.[20]

The reference period for the sunburn question (past 12 months) did not coincide with the reference periods for other questions (for example, sun protection during the summer) and the UV data (summer months). Although it is reasonable to assume that most sunburns occur during summer months, the survey was unable to identify sunburn from sources

What is already known on this subject?

- Sunburn and exposure to ambient ultraviolet radiation (UVR) are leading risk factors for skin cancer.
- Sunburns are more common among younger age groups, males, and higher income individuals.
- Women tend to protect themselves from the sun by seeking shade and wearing sunscreen, while men more frequently wear protective clothing

What does this study add?

- According to data from the Safety Module of the Canadian Community Health Survey, sunburn risk and sun protection behaviours were similar to those of previous studies.
- Women living in areas with greater ambient summer UVR were more likely to use most sun protection behaviours.
- Similar associations were not observed for men.
- Ambient summer UVR was only weakly associated with reporting a sunburn during the previous year.

such as winter vacations in warm climates, indoor tanning, and facial burns during outdoor winter sports.

Many important risk factors were not considered. The survey did not capture intermittent versus chronic exposure, and did not assess sunburn that occurred during sun vacations in the winter.[22] Respondents were not asked about their skin characteristics or tendency to burn.[22,23] Indoor tanning, an important risk factor for skin cancer (whether or not sunburns occur),[24] was not assessed.

In addition to the exclusion of some risk factors, the analysis did not consider all aspects of sunburn and sun protection. A U.S. study reported that 12% of people have at least four sunburns a year, most commonly, those who avoid the sun.[25] However, SSM data do not indicate the annual number of sunburns. The sunburn questions did not include the body site affected, although for men, sunburn on the trunk is a more important risk factor for melanoma than are other sites.[26] CCHS occupational data vary between cycles, so outdoor occupations were not assessed. However, outdoor workers spend considerable time in the sun and have different methods of sun protection—a survey of construction workers found that 79% use hats, and 82% use long-sleeved shirts.[26] It is not known if people who work outside use the same protective measures during their leisure time.

Conclusion

Based on data for six provinces, a third of people aged 18 or older had had a sunburn in the past year. Sunburns were more common among men, younger age groups, residents of higher income households, and people who were employed. To shield themselves from the sun, women were more likely than men to seek shade or apply sunscreen, while men were more likely to wear a hat or protective clothing. Among women, but not men, a positive association emerged between ambient summer UVR and protective behaviours. Given this association, in future research, it may be useful to examine how public health and UV Index messaging influences sun safety behaviour. ■

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